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(58) Field of Search
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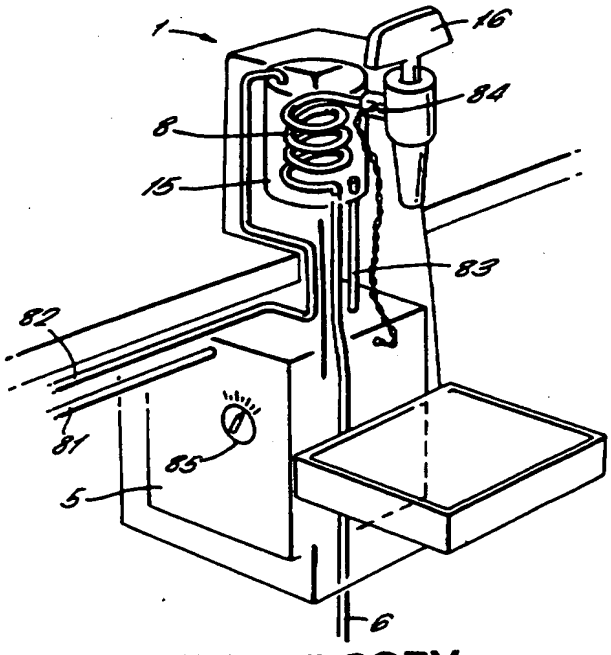
(54) Abstract Title
Cooling apparatus

(57) Apparatus (1) for controlling dispensation temperature of a beverage comprising one or more product flow tubes (6) extending from a storage point to a dispensation point. Cooling means are located at or near the dispensation point comprising a chamber (15) through which the product flow tubes (6) pass. Coolant flow lines (83) connect the cooling means to the chamber (15), wherein coolant is pumped from the cooling means to the chamber (15) where it immerses the product flow tubes (6) thus cooling the beverage within the product flow tube (6) within the chamber (15). The coolant is then passed via the coolant flow lines (83) to the cooling means where it is cooled and re-circulated. In addition, other apparatii are disclosed for cooling beverages at or near a dispensation point.

FIG. 5.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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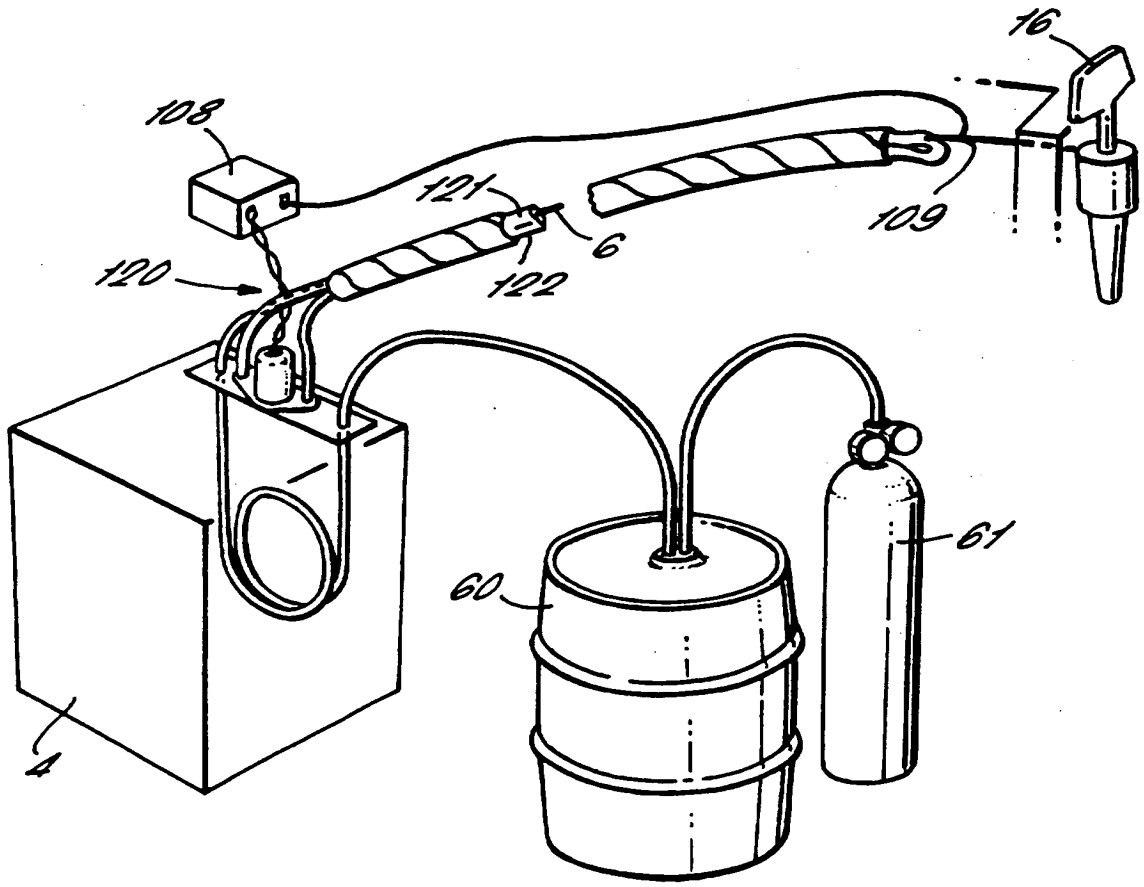
FIG. 1.



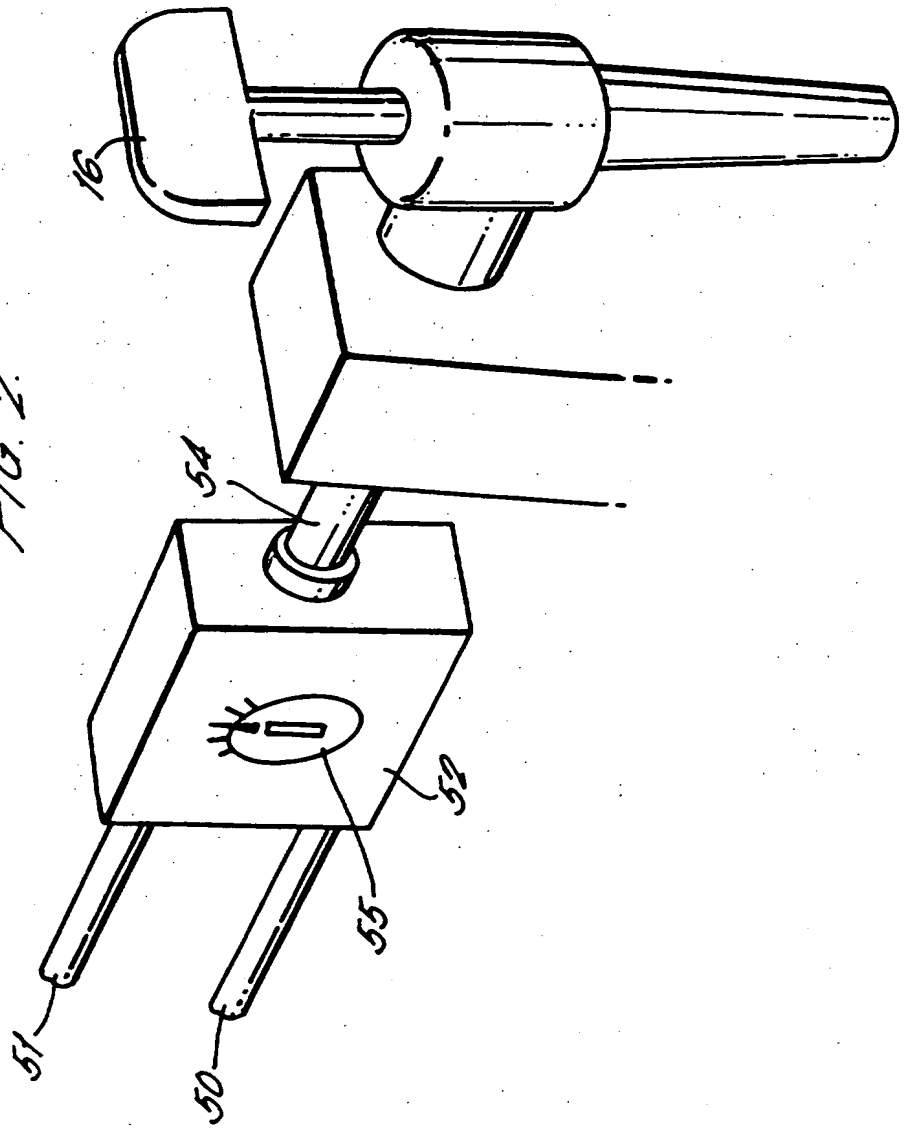
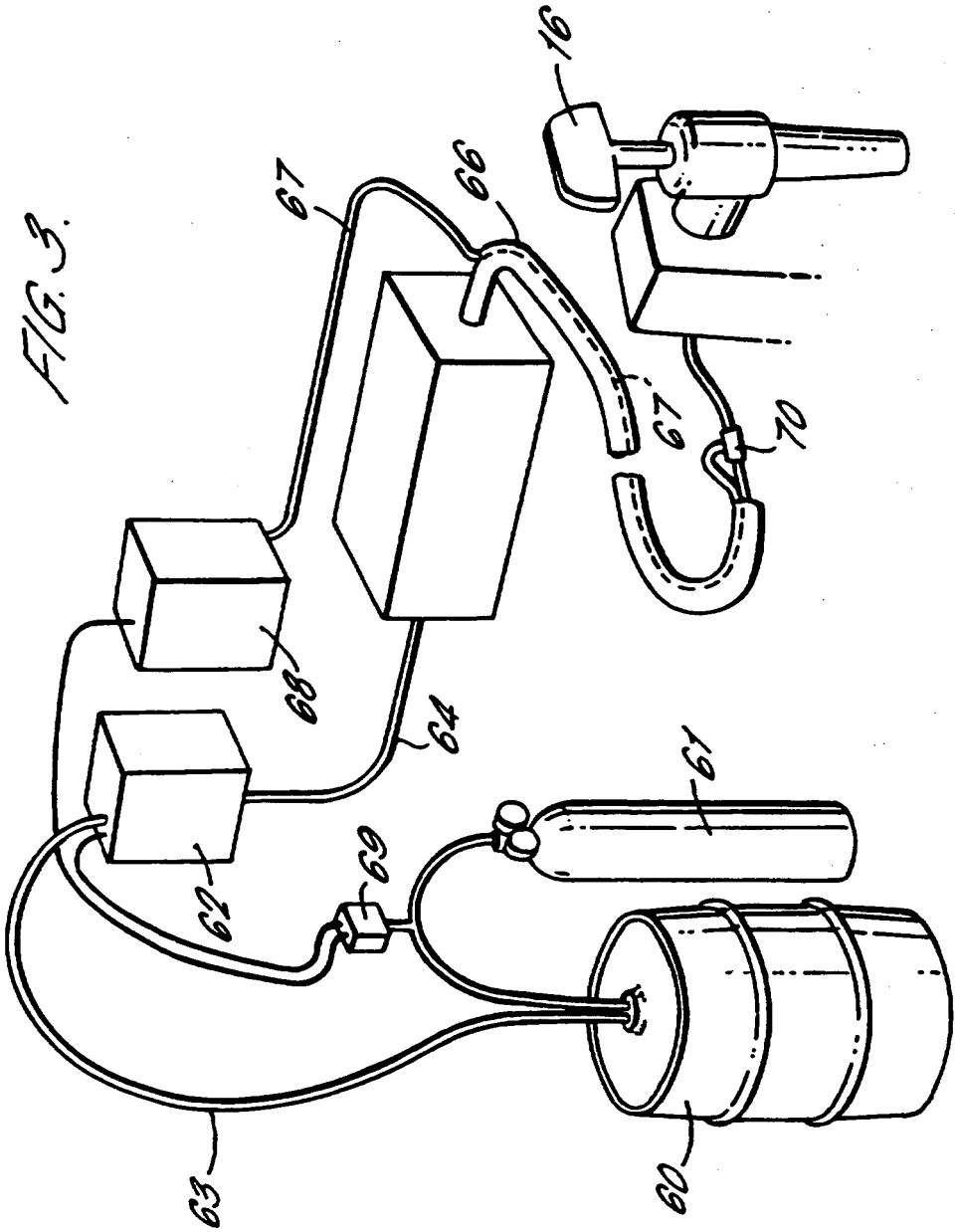


FIG. 2.

FIG. 3.



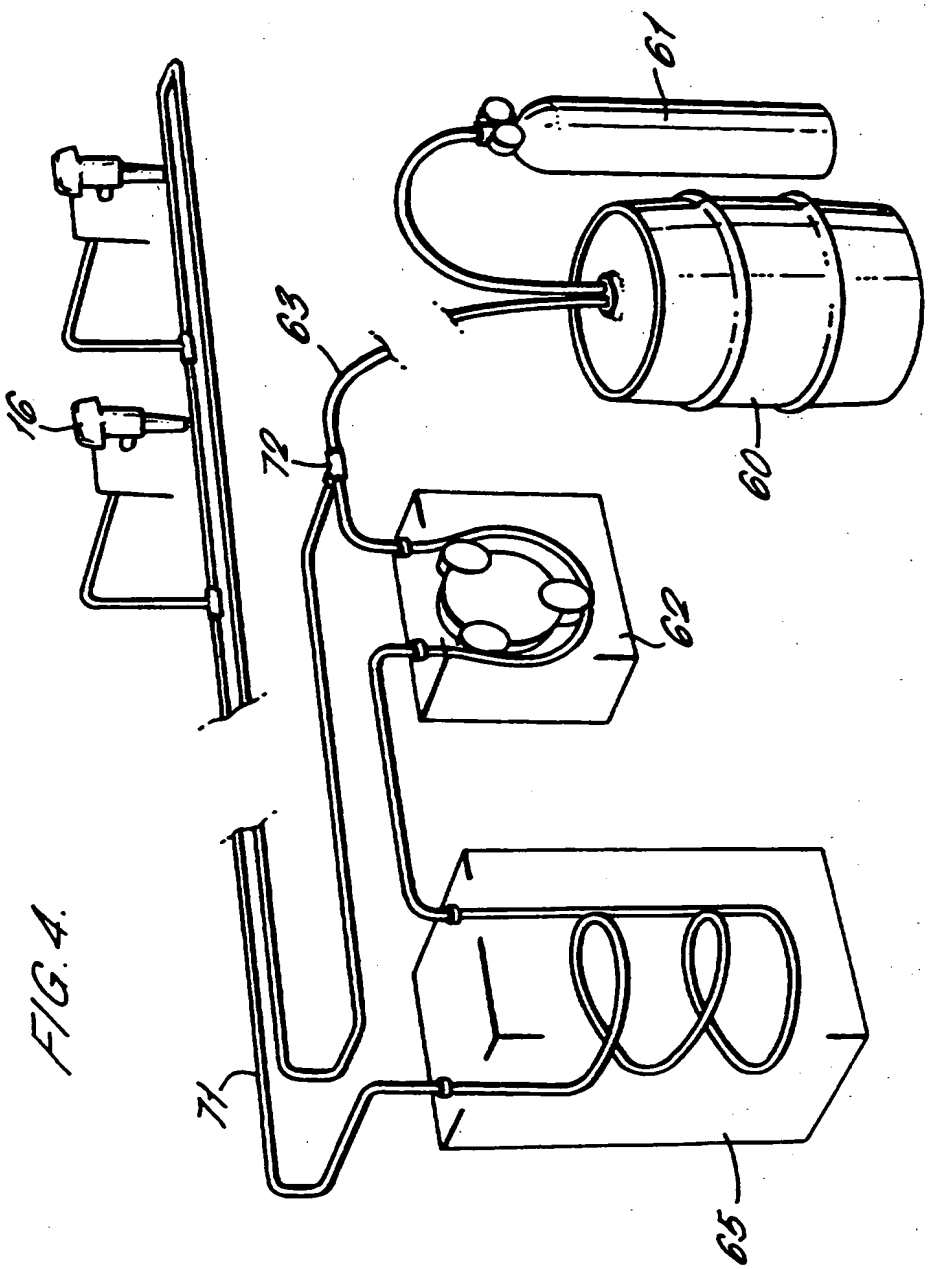


FIG. 4.

FIG. 5.

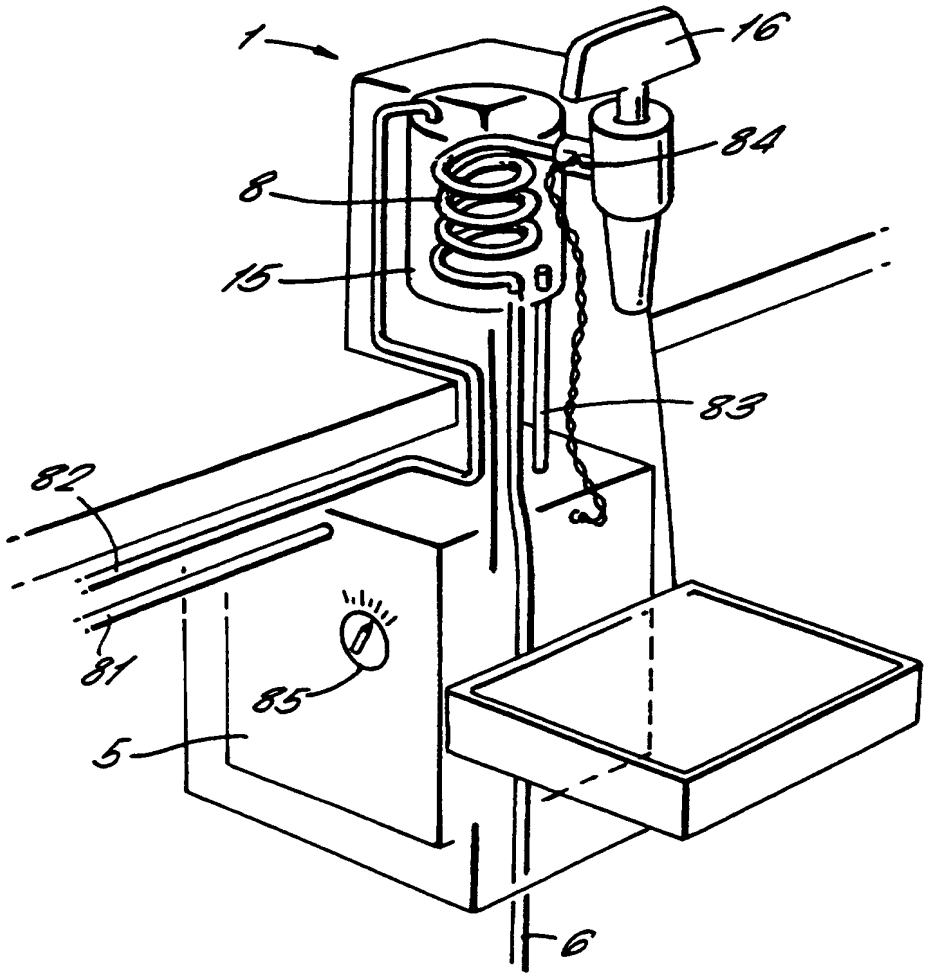
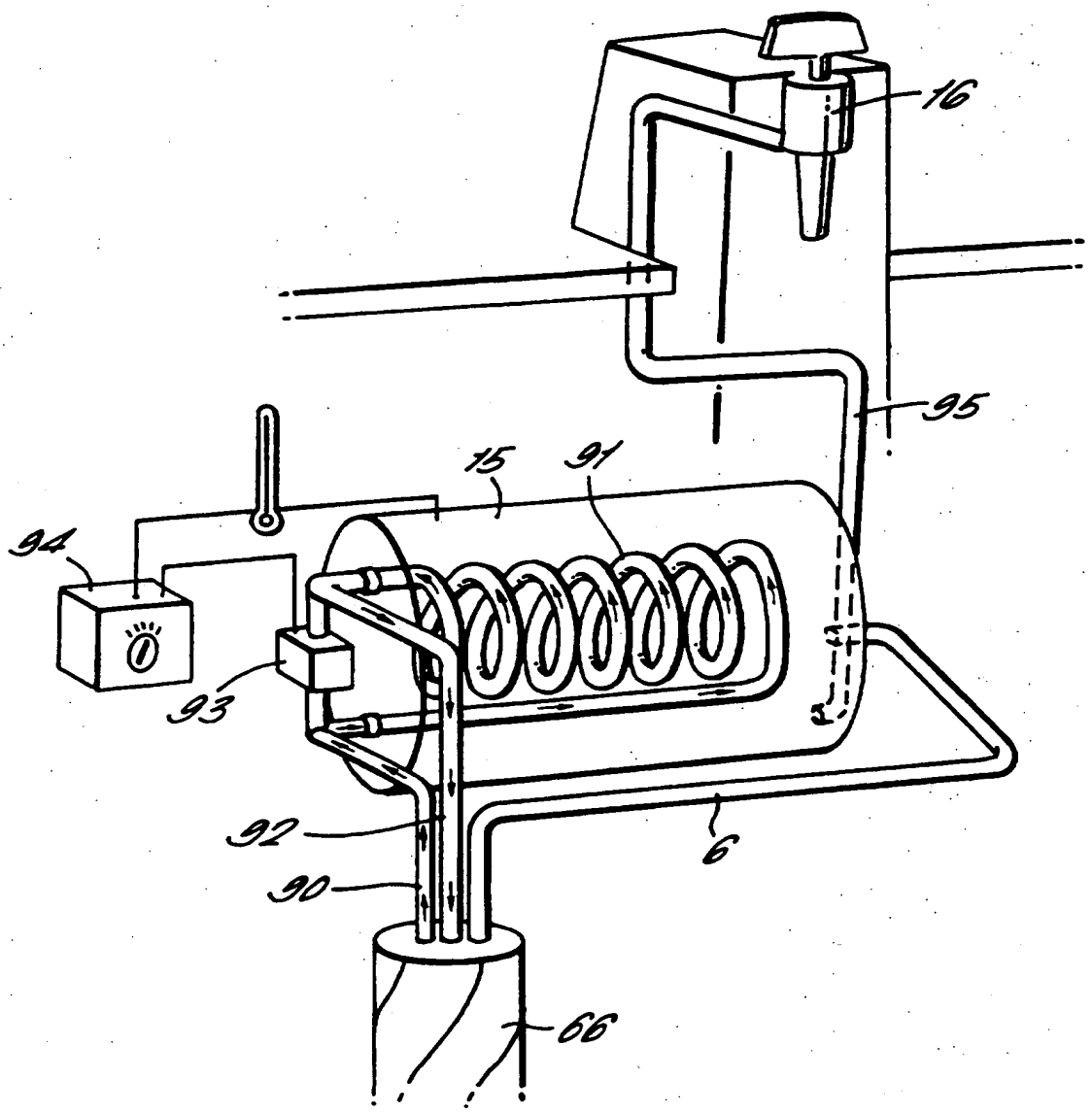


FIG. 6.



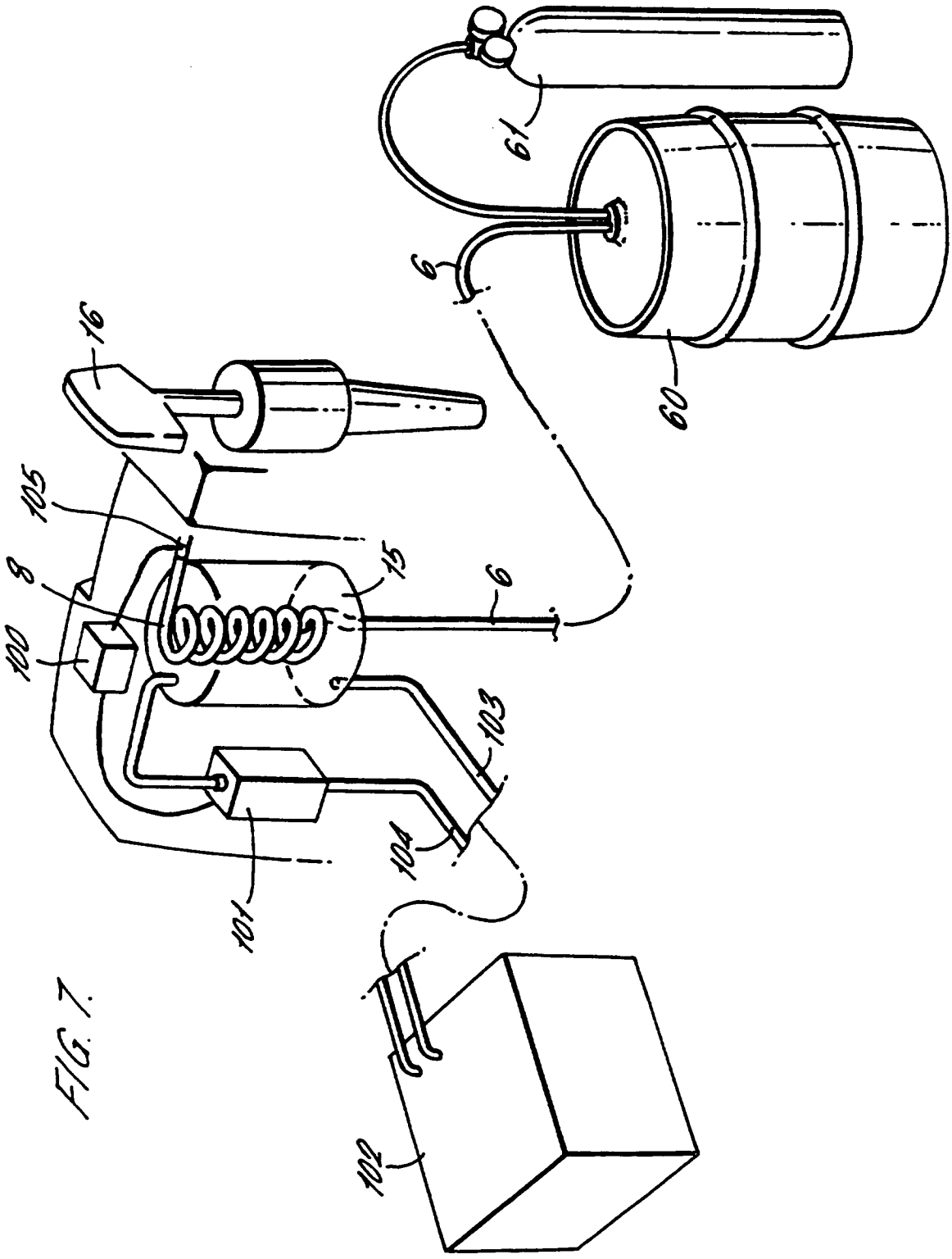


FIG. 7.

FIG. 8.

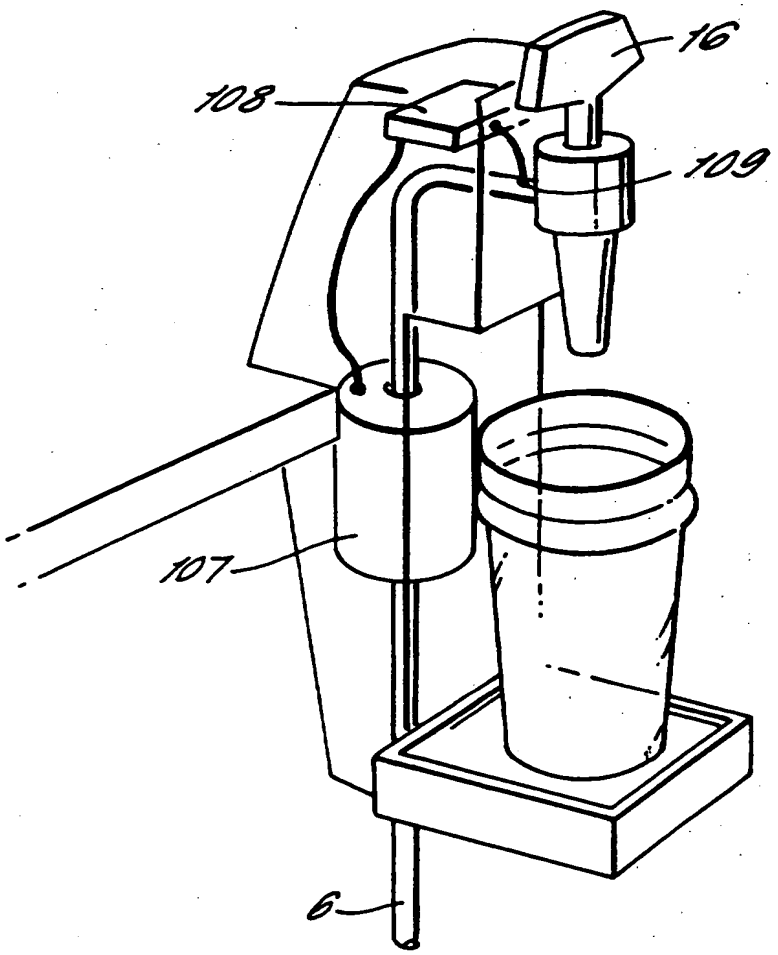


FIG. 9.

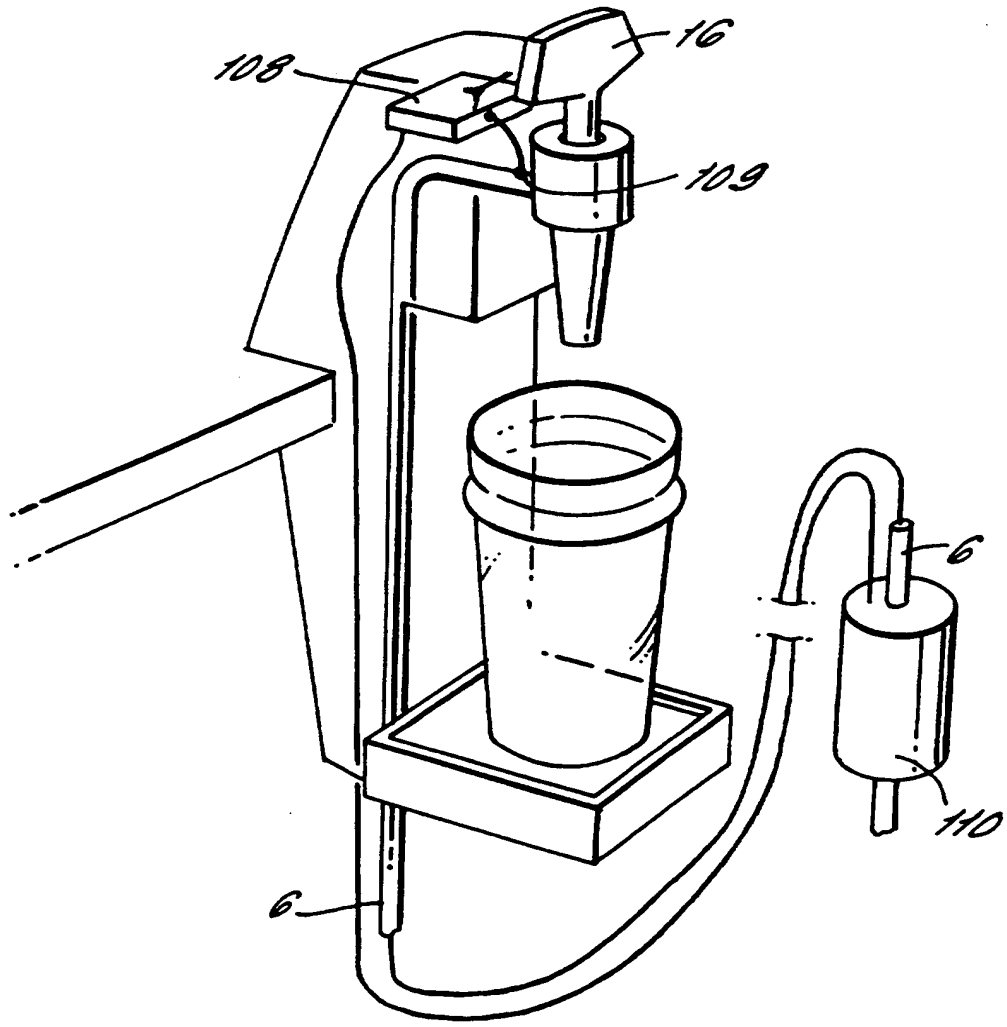
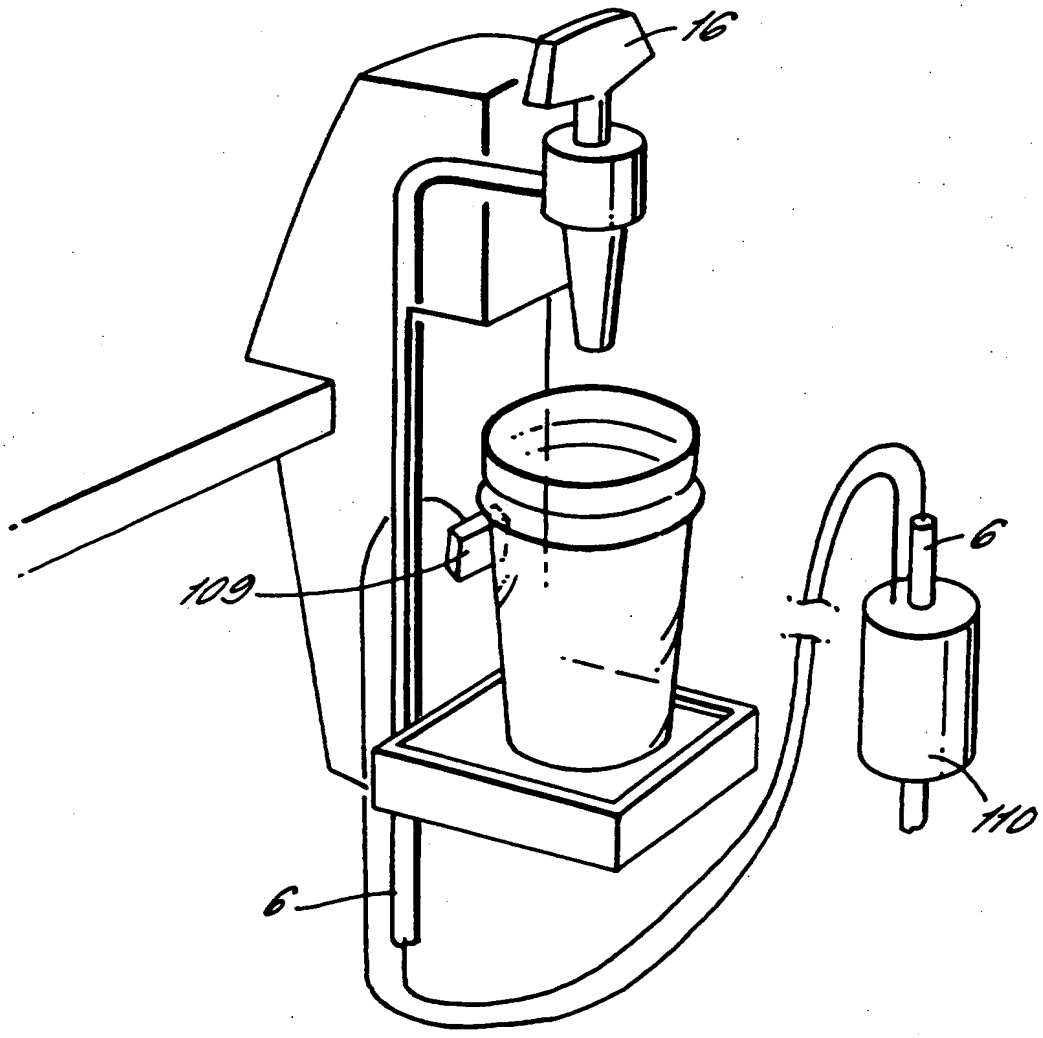


FIG. 10.



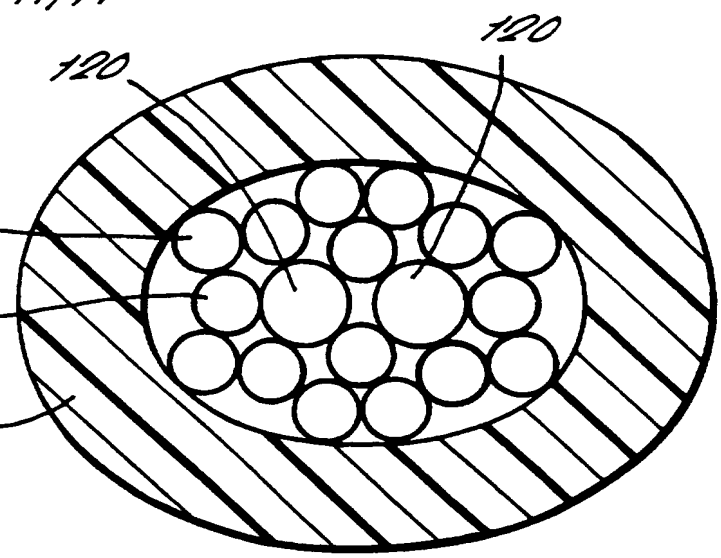


FIG. 11.

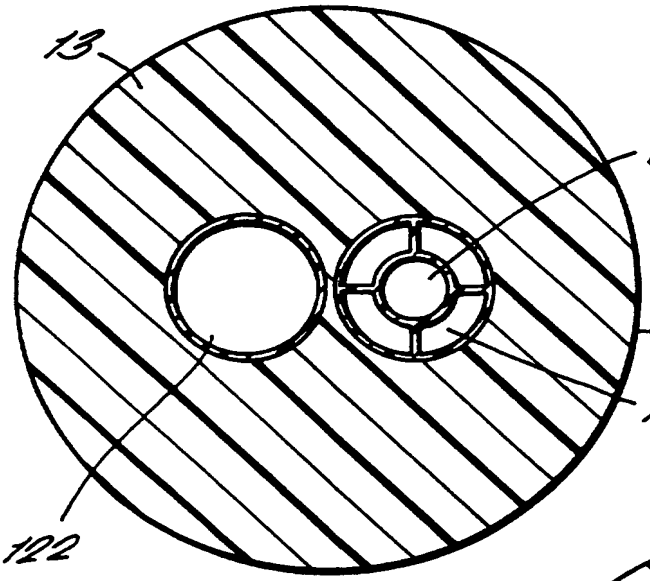


FIG. 12.

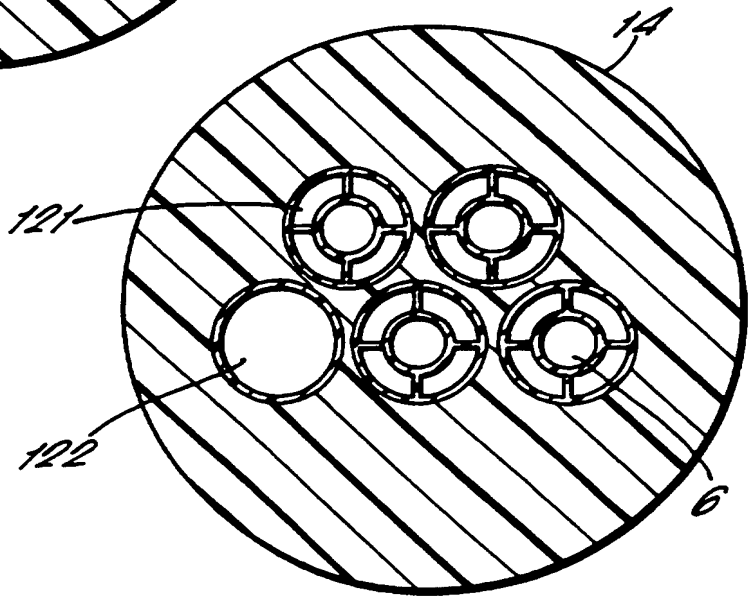


FIG. 13.

COOLING APPARATUS

Many beverages, including beers, lagers, soft drinks, milkshakes, wines and spirits are beneficially served at low temperatures. With some beverages a particular dispensation temperature is desired. If the temperature of the beverage is too high, the quality and taste of the beverage may be affected adversely. It is common for institutions such as Public Houses and bars to dispense such beverages by means of dispense taps remote from the point of storage of the beverage. For instance it is common for the beverage to be stored in a cellar or a separate room where it is cooled before being transferred to the point of dispensation at the bar. Commonly, this transfer is achieved by means of a pipe called a "python", which consists of one or more tubes each of which carries a flow of a particular beverage from the storage point to the dispense tap.

A problem with known methods of storing and dispensing beverages is that the temperature of the beverage dispensed can vary to a large degree especially at lower dispense temperatures, depending, for instance, on the utilisation level of the cooling means in the cellar. Also, the absolute temperature at which the beverage is dispensed is affected by the temperature of the room in which the beverage is stored and the environment through which the beverage is transported from the storage point to the dispense point. These effects may be exaggerated by the changing rate of dispensing beverages with standard systems. For instance, with most dispensing systems beverage is

left sitting in the tubes and pipes of the system inbetween dispensing operations. If there is some time between dispensing operations the stationary beverage may become very much hotter or colder than desired depending on where the beverage comes to rest. Beverage within the cooling means will become too cold whilst beverage contained in a python within the bar environment may become too hot. This leads to the dispensation temperature of individual beverages varying by unacceptable amounts.

It is therefore an object of the present invention to provide apparatus which enables beverages to be stored, transported and dispensed at predetermined, preferred temperatures and within a known tolerance of temperature range. It is also an object of the present invention to provide an economic means of dispensing beverages at lower temperatures than is now practical in a location such as a Public House or bar.

In a first area of improvement the present invention therefore discloses apparatus for transferring a beverage from a storage point to a dispensation point comprising one or more product flow tubes extending from the storage point to the dispensation point; cooling means remote from the dispensation point and one or more coolant flow lines extending from the cooling means to at or near the dispensation point through which coolant circulates; wherein the product flow tube(s) are located coaxial with, and inside the coolant flow line(s) between the cooling means and at or near the dispensation point.

Preferably a temperature sensor is provided at or near

the dispensation point to measure the temperature of beverage and a control means is also provided, connected to the temperature sensor and the cooling means to control the cooling means such that beverage is dispensed at a required temperature.

In a second area of improvement the present invention discloses apparatus for controlling the dispensation temperature of a beverage comprising a dispensation tap to which is supplied two or more product flow tubes through which beverage flows in use; wherein one product flow tube supplies relatively warm beverage and another flow tube(s) supplies relatively cold beverage; the apparatus further comprising a mixer unit in between the dispensation tap and product flow tubes to mix the beverage from the product flow tubes proportionally such that the beverage is dispensed at a required temperature.

Preferably the mixer unit comprises selectable control means to adjust the dispensation temperature of the beverage.

In a third area of improvement the present invention disclose apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes through which beverage flows in use connecting a storage point with a dispensation point; a cooling means through which the product flow tube(s) pass to cool the beverage therein; a first pumping means; a second pumping means and a control means connected to the first and second pumping means; wherein beverage is pumped by the first pumping means from a point near the storage point through the cooling means to a dispensation tap at the

dispensation point, such that beverage is dispensed when the dispensation tap is open; wherein beverage is pumped by the first pumping means from a point near the storage point through the cooling means to a flow tube junction at or near the dispensation point and down a secondary product flow tube to the second pumping means when the dispensation tap is closed; the control means switching the operation of the first and second pumping means to constantly circulate beverage between the first and second pumping means and the dispensation tap.

Preferably the secondary product flow tube passes through the cooling means such that the beverage therein is further cooled.

Preferably the product flow tube(s) between the cooling means and the dispensation point are located coaxial with, and within coolant flow lines containing coolant from the cooling means to further cool the beverage as it passes through the product flow tube(s).

The third area of improvement also discloses apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes extending from a storage point to a cooling means via a pumping means; wherein a product flow tube ring is provided between the cooling means and the dispensation point such that beverage flowing from the cooling means to the dispensation point via the product flow ring is recirculated to the cooler via the pumping means when a dispensation tap(s) are closed at the dispensation point.

Preferably the product flow ring is located coaxial with, and within a coolant flow line through which coolant from the cooling means circulates to cool the beverage within the product flow ring.

A fourth area of improvement of the present invention discloses apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes extending from a storage point to a dispensation point; cooling means located at or near the dispensation point; a chamber at or near the dispensation point through which the product flow tube(s) pass; and coolant flow lines connecting the cooling means to the chamber; wherein coolant is pumped from the cooling means to the chamber where it immerses the product flow tube(s), thus cooling the beverage within the product flow tube(s) within the chamber, and is then passed via the coolant flow lines to the cooling means where it is and recirculated.

Optionally a temperature sensor is provided at or near the dispensation point to monitor the temperature of beverage dispensed, the cooling means being connected to the temperature sensor and automatically adjustable to change the flow rate of coolant through the chamber to achieve the desired dispensation temperature.

The fourth area of improvement further discloses apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes extending from a storage point to a chamber at or near the dispensation point; a secondary product flow tube extending between the chamber and the dispensation point; and coolant flow lines connected to a coolant flow coil within the chamber; wherein

beverage is pumped into the chamber via the product flow tube(s) before passing along the secondary product flow tube to the dispensation point and coolant is pumped through the coolant flow lines and coolant flow coil to cool the beverage in the chamber.

Preferably temperature sensing means are provided to monitor the temperature of the beverage stored in the chamber and control means are provided to adjust the flow rate of coolant through the coolant flow coil in response to the temperature sensor readings to achieve a required dispense temperature of beverage.

The fourth area of improvement also discloses apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes extending from a storage point to a dispensation point; cooling means located at or near the dispensation point; an expansion chamber at or near the dispensation point through which the product flow tube(s) pass; and coolant flow lines connecting the cooling means to the expansion chamber; wherein volatile liquefied coolant is pumped from the cooling means to the expansion chamber where it boils to form a gas, thus cooling the beverage within the product flow tube(s) within the expansion chamber, and is then passed via the coolant flow lines to the cooling means where it is compressed and recirculated.

Preferably a temperature sensor is provided at or near the dispensation point to monitor the temperature of beverage dispensed, the cooling means being connected to the temperature sensor and automatically adjustable to change the flow rate of propellant through the expansion chamber to achieve the desired dispensation

temperature.

Preferably the propellant is 134a.

In a fifth area of improvement the present invention discloses apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes extending from a storage point to a dispensation point; a heater unit through which the product flow tube(s) pass to heat the beverage therein; temperature sensing means to monitor the dispensation temperature of the beverage, the output of the sensing means being connected to the heater unit; wherein the beverage is cooled remote from the dispensation point to a temperature below a required temperature and the heater unit raises the temperature of the beverage to the required temperature, the heater unit adjusting the rate of heating with regard to feedback from the temperature sensing means such that the required dispensation temperature is maintained.

Preferably the heater unit is located at or near the dispensation point.

Alternatively the heater unit is located remote from the dispensation point.

Preferably the temperature sensing means is located in the product flow tube(s) at or near the dispensation point.

Alternatively the temperature sensing means is located in contact with a container containing the dispensed beverage.

The present invention discloses several areas of improvement over known cooling systems for beverage dispensing. Unless otherwise required by the context these areas of improvement may be utilised individually or in combination to meet the desired objectives. Embodiments of the areas of improvement will now be described, by way of example only, with reference to the following drawings, of which:

Figure 1 is a schematic diagram of a first area of improvement of the present invention;

Figure 2 is a schematic diagram of a second area of improvement of the present invention;

Figure 3 is a schematic diagram of a third area of improvement of the present invention;

Figure 4 is a schematic diagram of a further embodiment of a third area of improvement of the present invention;

Figure 5 is a schematic diagram of a fourth area of improvement of the present invention;

Figure 6 is a schematic diagram of another embodiment of a fourth area of improvement of the present invention.

Figure 7 is a schematic diagram of another embodiment of a fourth area of improvement of the present invention.

Figure 8 is a schematic diagram of a fifth area of improvement of the present invention.

Figure 9 is a schematic diagram of another embodiment of a fifth area of improvement of the present invention.

Figure 10 is a schematic diagram of a further embodiment of a fifth area of improvement of the present invention.

Figure 11 is cross-sectional view of a prior art 'python'.

Figure 12 is a cross-sectional view of python according to the present invention.

Figure 13 is a cross-sectional view of a python according to the present invention.

A first area of improvement is in the means of transporting the beverage between the storage point and the dispensation point. With prior art pipes or 'pythons', which are typically 30 metres or more in length, the beverage temperature is affected by the temperature of the environment through which the python passes. Figure 1 shows a 'cooled' python which allows beverage to be transported between the storage and dispensation points whilst maintaining the beverage at the required temperature. The python comprises a product flow tube 6 and a coolant flow tube 120. The coolant flow tube has an 'outward' section 121 running between a cooler 4 and a point

near the dispensation tap 16 and an 'inward' section 122 which runs between a point near the dispensation tap 16 and the cooler 4. The outward and inward sections 121, 122 are connected at the end nearest the dispensation tap 16 such that coolant flowing along the outward section 121 is recirculated via the inward section 122 to the cooler 4. No coolant is lost from the system, thus saving on energy and cost and reducing potential pollution from discharged coolant. The product flow tube 6, as shown in Figure 12, runs co-axial with, and inside the outward section 121 such that the coolant flowing in the outward section 121 of the coolant flow tube 120 flows around the product flow tube 6 at all points, thereby cooling the beverage in the product flow tube 6. In addition, the python also comprises insulation 13 and an outer cover 14. The insulation 13 serves to insulate the relatively high temperature 'inward' section of the coolant flow tube 120 from the relatively low temperature 'outward' section of the coolant flow tube 120 and the product flow line 6. The outer cover 14 serves to lend the python structural integrity and to protect it from damage. The python may also incorporate a service tube for the transport of pressurised gas to the dispense point.

The co-axial cooled python may be manufactured either by sliding one tube within another or by extruding the co-axial tubes in one piece. An extruded co-axial python may comprise strengthening ribs 123 between the product flow tubes 6 and the outward sections of the coolant flow tubes 121. The ribs help to maintain the flow path for coolant through the python, especially

when the python is curved around corners.

The product flow tube 6 may in addition have circumferential ribs along its length. These increase the surface area of the tube 6 available for heat exchange with the coolant in the coolant flow tube 121. They also aid the bending flexibility of the python.

The product flow tube 6 and coolant flow tube 120 may be manufactured from MDPE (medium density polyethylene). In one embodiment of the present invention the product flow tube 6 has an external diameter of 9.5 mm and an internal diameter of 6.7 mm within a coolant flow tube 120 having an external diameter of 18 mm and an internal diameter of 13 mm.

The ability of the python of the present invention to maintain the beverage at the required temperature at which it leaves the cooler 4, especially at low temperatures, is much greater than in prior art arrangements, like that shown in Figure 11, where the product flow tube 6 and coolant flow tube 120 are juxtaposed so that they lie side by side within the python. The cooling of the product flow tubes 6 in prior art pythons is very variable and depends for example on the packing arrangement of the python and the consequent distance of any product flow tube 6 from the coolant flow tube 121. The encapsulation of the product flow tube 6 in the coolant flow tube 120 provides consistent cooling of the beverage and a more efficient thermal coupling between the beverage and the coolant.

A temperature sensor 109 can be provided near a dispense tap 16 at the dispensation point to measure the temperature of the beverage either just before dispensation or just after. This information is relayed to a control means 108 which controls the quantity and/or degree of cooling of the coolant circulated in the coolant flow tube 120 by the cooler 4. In this way feedback is used to accurately control the dispense temperature of the beverage. Alternatively the temperature sensor 109 may be located remote from the dispensation point to monitor the temperature of the coolant in the inward section of the coolant flow tube 122 as it returns from the dispense point. If a good thermal coupling is established between the coolant flow tube 120 and the product flow tube 6 then the increase in temperature of the coolant will be indicative of the temperature decrease of the beverage in the product flow tube 6. An advantage of this arrangement is that the temperature sensor 109 is situated in the same location as the control means 108 and the sensor 109 is not in contact with the beverage during use, which is more hygienic and also reduces cleaning requirements.

The python may carry more than one type of beverage and may service more than one dispense tap 16. In this case, the python would comprise a product flow tube 6 for each type of beverage. As shown in Figure 13, the python may comprise three product flow tubes to service a T-bar font having three dispense taps 16. Each product flow tube 6 is within an outward section of a coolant flow tube 121. A single inward section of

a coolant flow tube 122 is sufficient to recirculate the coolant back to the cooler 4 from each of the outward sections 121. The python may also comprise four product flow tubes or any other suitable number to service the required dispense tap apparatus. Alternatively, if there are multiple dispense taps 16 but each dispense tap 16 is to dispense the same beverage, the python may comprise only a single product flow tube 6 which is designed to split near the point of dispensation into a number of flow lines, each one connected to a separate dispense tap 16. Where multiple product flow lines 6 are used multiple coolant flow tubes 120 may also be incorporated in the python to increase the degree of cooling of the product flow lines 6.

A second area of improvement in the control of the dispensation temperature of a beverage is shown in Figure 2. The dispensing tap 16 through which the beverage is dispensed is supplied with a warmer flow of beverage and a cooler flow of beverage by means of two beverage flow lines 50, 51. A mixer unit 52 receives the two beverage flow lines 50, 51 and outputs the required proportions of the warmer and cooler flows to the dispense tap 16 via a supply line 54 to achieve the required dispensation temperature of the beverage. The mixer unit 52 may comprise a jet pump mixer driven by the cooler flow of beverage, a thermostatic mixer valve or a three port valve with time proportioning control. Optionally the mixer unit 52 enables the beverage to be dispensed at multiple, different temperatures by means of an adjustable control switch 55.

A third area of improvement over the prior art is a means to prevent beverage from standing stationary within the dispensing apparatus for substantial periods. Figure 3 shows a dispensing system comprising a storage medium, such as a keg 60, which is pressurised in use by means of a pressurised gas cylinder 61. The cylinder 61 may contain nitrogen, carbon dioxide or other suitable gases as known in the art. The keg 60 is connected to a first pumping chamber 62 by means of a product flow tube 63. A further product flow tube 64 connects the first pumping chamber 62 to an ice bank cooler 65. The product flow tube 64 passes through the ice bank cooler 65 wherein the beverage within the product flow tube 64 is cooled to a desired temperature. The beverage is then transported from the ice bank cooler 65 to the dispense tap 16 by means of a python 66 containing the product flow tube 64. Preferably the python 66 also contains a supply of coolant as described above to maintain the beverage at the required temperature as it transfers between the ice bank cooler 65 and the dispense tap 16. The product flow tube 64 also comprises a branch connection 70 at an end of the python 66 nearest the dispense tap 16. Thus, in use when the dispense tap 16 is shut off beverage pumped down the product flow line 64 is diverted by the branch connection 70 down a product return line 67 to a second pumping chamber 68. The product return line 67 is located within the cooled python 66 helping to maintain the temperature of the beverage at the desired level. A control means 69 connected to the first pumping chamber 62, second pumping chamber 68 and gas supply 61 controls which

pumping chamber is pumping at each point of the cycle. In use beverage initially flows from the keg 60 to the dispense tap 16 via the first pumping chamber 62, product flow line 64, cooler 65 and python 66. If the dispense tap 16 is open, beverage is dispensed. If the dispense tap is shut the beverage flows back to the second pumping chamber 68 via the product return line 67 where it is stored. At a set point determined by the programming of the control means 69 the second pumping chamber 68 takes over from the first pumping chamber 62 to pump the beverage back from the second pumping chamber 68 to the dispense tap 16 via the product return line 67. If the dispense tap 16 is now open the beverage is dispensed. If still shut the beverage is diverted back to the first pumping chamber 62 via the product flow line 64 and cooler 65. Thus the beverage is constantly flowing in a reciprocating circuit through the components of the apparatus and is never stationary. This has the advantage that the severity of 'hot-spots' (where beverage in the apparatus locally over-heats due to being held for substantial periods in a hotter environment) is reduced which reduces the 'fobbing', where beverage over-foams, of the beverage. Optionally the product return flow line 67 may be directed back through the cooler 65 to increase the degree of cooling imparted to the beverage. The capacity of the first and second pumping chambers 62, 68 is large enough to ensure that beverage always passes right the way through the apparatus from one pumping chamber to the other on each half-cycle of the reciprocating motion before the direction of flow is reversed. In this way no beverage is left in the system simply moving to and fro in the

product flow line 64 and product return line 67 without passing through the cooler 65. When beverage is dispensed from the dispense tap 16 and thus exits the reciprocating circuit the control means 69 switches pressures to pump further beverage from the keg 60 into the first pumping chamber 62.

Advantages of this system include an absence of moving parts which increases the reliability of the system and reduces noise. The pumping chambers 62, 68 rely on heads of pressure over the beverage stored therein to pump the beverage through the system and do not create pulses of pressure which can lead to spluttering and fobbing of the beer dispensed.

Figure 4 shows a different means of preventing stationary beverage in a dispensing system. The keg 60, cylinder 61 and flow line 63 are as described above. The cooler 65, pumping chamber 62 and dispense tap or taps 16 are connected in a ring main. Beverage is pumped through the cooler 65 to the taps 16. If none of the taps are open the beverage is recirculated via a branch connection 72 to the pumping chamber 62. A non-return valve in the flow line 63 prevents flow of beverage from the branch connection 72 down the flow line 63 towards the keg 60.

This system is simple and it is easy to connect a number of taps 16 to one pumping chamber 62. The system is also easy to clean.

A fourth area of improvement is the direct control of the temperature of the beverage at or near the

dispense point. Figure 5 shows a system comprising a dispense unit 1 and a cooling system 5. The dispense unit 1 contains a chamber 15 in which a product flow coil 8 is situated. One or more product flow lines 6 are connected to one or more product flow coils 8 which in turn are connected to one or more dispense taps 16. Figure 5 shows an embodiment with one product flow tube 6, coil 8 and tap 16. The cooling system 5 comprises a coolant inlet 81 and a chamber supply line 83 connected between the cooling system 5 and the chamber 15. A coolant, which is chilled remote from the dispensation point, such as glycol is supplied to the cooling system 5 from an external supply via the coolant inlet 81. There it is passed via the chamber supply line 83 into the chamber 15 before circulating back via a coolant outlet 82. The beverage passes through the product flow coil 8, which is submersed in the chilled glycol, immediately before being dispensed via the tap 16. The cooling system 5 comprises control means 85 to allow the adjustment of the flow rate of the glycol through the chamber 15 and hence the degree of cooling of the beverage. The dispense tap 16 comprises a temperature sensor 84 which measures the temperature of the beverage at the point of dispensation and passes this information to the control means 85 which can then adjust the flow rate of the glycol to maintain the required temperature. The flow rate of glycol through the chamber 15 can be reduced to zero, if the beverage becomes over-chilled, by diverting the glycol from the coolant inlet 81 to the coolant outlet 82 without the glycol passing through the chamber 15. This method is preferably to stopping the flow of glycol in the coolant inlet 81

and outlet 82 since this would lead to the glycol temperature rising uncontrollably via heat exchange with the environment. Alternatively water may be used instead of glycol as the coolant. The water may be tapped from the coolant flow tube 120 of a cooled python as described above if utilised. This system allows for a large degree of cooling of the beverage by utilising glycol which can be circulated through the system at low temperatures around -2 degrees Celsius.

This improvement enables beverages to be dispensed down to a temperature of 2°C where the coolant is water and down to a temperature of -3.0°C where the coolant is glycol. In addition, the temperature range of the beverage at the point of dispensing can be maintained more accurately than in know systems where the variability in temperature can exceed plus or minus 3°C at low temperatures. A margin of error of plus or minus 2.0°C is attainable with the present invention where a conventional python is used between the storage point and chamber 15, and plus or minus 1.0°C where a cooled python as described above is used. Water is the preferred coolant where the desired temperature of beverage is not below 2°C since water is more economical in use than glycol. Also Public Houses and bars generally already have supplies of water connected. Glycol is the preferred coolant where lower temperatures of beverage are required and/or a greater control of the temperature of the product is important to the quality of the beverage dispensed.

In a modified embodiment of the present invention shown in Figure 5 the chamber 15 comprises a double wall such that a secondary volume is formed separate from the volume in which the product flow coil 8 is situated. Coolant is circulated through the secondary volume only such that the product flow coil 8 is surrounded only by air. The coolant in the secondary volume chills the air surrounding the product flow coil 8 which therefore cools the beverage.

The chamber 15 of either embodiment may be situated either above or below the level of the bar. Preferably the chamber 15 is situated above the level of the bar such that it is visible to the customer. It has been found that the presence of chilled water within the chamber 15 causes water to condense on the outside surface of the chamber 15 in use. This has aesthetic appeal to the customer by reinforcing the impression that the beverage is cold. Where glycol is used as the coolant it has been found that ice may form on the outside surface of the chamber 15. Likewise this is advantageous and appealing to customers.

The system is also flexible due to the feedback from the temperature sensor 84 and can thus adjust for variability in the supplied beverage and environment, even during the dispensation of a single beverage.

Figure 6 shows a second apparatus for controlling the temperature of the dispensed beverage at the point of dispensation. The product flow line 6 is piped to the vicinity of the dispense tap 16 in a cooled python 66. Coolant flow lines 90, 91 within the python 66 are

connected to a coolant flow coil 91 within a chamber 15. The product flow line 6 is also connected to the chamber 15 such that beverage is piped into the chamber 15 where it surrounds the coolant flow coil 91. A secondary product flow line 95 is connected between the chamber 15 and the tap 16. Thus coolant flowing in the coolant flow coil 91 cools the beverage as it passes to the tap 16. The degree of cooling may be adjusted by means of a controller 94 connected to a temperature sensor and a switchable valve 93 which can switch the flow of coolant such that the coolant either does or does not pass through the coolant flow coil 91 before recirculating down the python 66. The coolant may be chilled water, glycol or other suitable medium. An advantage of this system is that the chamber 15 can store a volume of beverage equivalent to a number of servings. Thus the ability of the system to respond to rapid rises in demand is increased. Also the large volume ensures that the dispensing of a single beverage does not alter the temperature of the stored beverage to a large degree thus a more consistent dispensation temperature, between beverages is achieved.

A third apparatus for trimming the dispensation temperature is shown in Figure 7. The beverage is piped from a pressurised keg 60 in a product flow pipe 6 which is connected to a product flow coil 8 within a chamber 15. The product flow coil 8 is then connected to a standard dispensing tap 16. An auxiliary cooler 102 containing a compressor is connected in fluid communication with the chamber by means of propellant flow pipes 103, 104. In use substantially liquefied

propellant, such as hydro chlorofluorocarbon 134a, is pumped into the chamber 15 from the cooler 102 via the propellant flow line 103. The liquefied propellant expands within the chamber changing state from a liquid to a gas. The energy input to achieve the boiling of the propellant is provided by heat exchange from the beverage in the product flow coil 8. Hence the beverage is cooled. The gaseous propellant is circulated back to the cooler 102 via the propellant flow line 104 where it is compressed and liquefied ready to be recirculated. Feedback for controlling the dispense temperature of the beverage is provided by a temperature sensor 105 near the dispense tap 16 which relays information to a control means 100 which controls the flow of propellant through the apparatus by means of a valve 101. The system may comprise more than one product flow coil 8 in a single chamber 15, connected to more than one dispense tap 16. This system is very responsive and is able to cope with rapid changes in the temperature of the beverage arriving in the chamber 15. The flow pipe 6 may be conventional or a cooled python as described above.

A fourth apparatus for trimming the temperature of the beverage dispensed is shown in Figure 8. The product flow pipe 6 feeds into a heater unit 107 near the dispense tap 16. A temperature sensor 109, such as a thermocouple, is provided in the dispense tap 16 to measure the temperature of the dispensed beverage. A control unit 108 registers the temperature of the out put of the sensor 109 and switches the heater unit 107 as required. In use beverage is supplied to the heater unit 107 at a temperature below the required dispense

temperature. The heater unit 107 then heats up the beverage to the correct temperature. This system is advantageous since it is much quicker to raise the temperature of a liquid than lower it. Also the required apparatus to heat the beverage is more compact than the apparatus required to cool the beverage. Thus the bulky cooling equipment may be kept remote from the bar area and relatively small heater units installed below the bar, where space is at a premium. A requirement for the apparatus to work is that the beverage does not warm up by too great a degree before arriving at the heater unit 107. Therefore it is preferred that the apparatus utilises a cooled python as described above for transferring the beverage. The 'subcooling' of the beverage may be achieved by, for instance, a glycol chiller.

A fifth area of improvement is shown in Figure 9. In this apparatus the beverage is subcooled using a cooler 110 remote from the dispense tap 16 and the beverage is allowed to rise in temperature as it transfers along the product flow pipe 6 such that it has reached the desired temperature at the dispense tap 16. A temperature sensor 109 in the dispense tap 16 and control means 108 provides feedback to the cooler 110 to adjust the degree of cooling of the beverage. An advantage of this system is that the power electrics for operating the apparatus are remote from the bar environment. Preferably the apparatus comprises narrow bore pipes between the cooler 110 and the dispense tap 16 to minimise the volume of beverage that might be left stationary for substantial periods and thus allowed to heat up.

Alternatively the temperature sensor 109 may be positioned to measure the temperature of the dispensed beverage as shown in Figure 9. The sensor 109 may be in contact with the outside of the container containing the beverage or in contact with the beverage itself. **An advantage of measuring the temperature of the beverage in the container after dispensation is that the unknown temperature of the container is taken into account by the cooling feedback system. Thus a beverage dispensed into a warm or hot container is dispensed at a lower temperature such that the final beverage, once the temperatures have equalised, is served at the correct temperature.**

Claims

1. Apparatus for transferring a beverage from a storage point to a dispensation point comprising one or more product flow tubes extending from the storage point to the dispensation point; cooling means remote from the dispensation point and one or more coolant flow lines extending from the cooling means to at or near the dispensation point through which coolant circulates; wherein the product flow tube(s) are located coaxial with, and inside the coolant flow line(s) between the cooling means and at or near the dispensation point.

2. Apparatus as claimed in claim 1 wherein a temperature sensor is provided at or near the dispensation point to measure the temperature of beverage and a control means is also provided, connected to the temperature sensor and the cooling means to control the cooling means such that beverage is dispensed at a required temperature.

3. Apparatus for controlling the dispensation temperature of a beverage comprising a dispensation tap to which is supplied two or more product flow tubes through which beverage flows in use; wherein one product flow tube supplies relatively warm beverage and another flow tube(s) supplies relatively cold beverage; the apparatus further comprising a mixer unit in between the dispensation tap and product flow tubes to mix the beverage from the product flow tubes proportionally such that the beverage is dispensed at a required temperature.

4. Apparatus as claimed in claim 3 wherein the mixer

unit comprises selectable control means to adjust the dispensation temperature of the beverage.

5. Apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes through which beverage flows in use connecting a storage point with a dispensation point; a cooling means through which the product flow tube(s) pass to cool the beverage therein; a first pumping means; a second pumping means and a control means connected to the first and second pumping means; wherein beverage is pumped by the first pumping means from a point near the storage point through the cooling means to a dispensation tap at the dispensation point, such that beverage is dispensed when the dispensation tap is open; wherein beverage is pumped by the first pumping means from a point near the storage point through the cooling means to a flow tube junction at or near the dispensation point and down a secondary product flow tube to the second pumping means when the dispensation tap is closed; the control means switching the operation of the first and second pumping means to constantly circulate beverage between the first and second pumping means and the dispensation tap.

6. Apparatus as claimed in claim 5 wherein the secondary product flow tube passes through the cooling means such that the beverage therein is further cooled.

7. Apparatus as claimed in either claims 5 or 6 wherein the product flow tube(s) between the cooling means and the dispensation point are located coaxial with, and within coolant flow lines containing coolant

from the cooling means to further cool the beverage as it passes through the product flow tube(s).

8. Apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes extending from a storage point to a cooling means via a pumping means; wherein a product flow tube ring is provided between the cooling means and the dispensation point such that beverage flowing from the cooling means to the dispensation point via the product flow ring is recirculated to the cooler via the pumping means when a dispensation tap(s) are closed at the dispensation point.

9. Apparatus as claimed in claim 8 wherein the product flow ring is located coaxial with, and within a coolant flow line through which coolant from the cooling means circulates to cool the beverage within the product flow ring.

10. Apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes extending from a storage point to a dispensation point; cooling means located at or near the dispensation point; a chamber at or near the dispensation point through which the product flow tube(s) pass; and coolant flow lines connecting the cooling means to the chamber; wherein coolant is pumped from the cooling means to the chamber where it immerses the product flow tube(s), thus cooling the beverage within the product flow tube(s) within the chamber, and is then passed via the coolant flow lines to the cooling means where it is cooled and recirculated.

11. Apparatus as claimed in claim 10 wherein a temperature sensor is provided at or near the dispensation point to monitor the temperature of beverage dispensed, the cooling means being connected to the temperature sensor and automatically adjustable to change the flow rate of coolant through the chamber to achieve the desired dispensation temperature.

12. Apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes extending from a storage point to a chamber at or near the dispensation point; a secondary product flow tube extending between the chamber and the dispensation point; and coolant flow lines connected to a coolant flow coil within the chamber; wherein beverage is pumped into the chamber via the product flow tube(s) before passing along the secondary product flow tube to the dispensation point and coolant is pumped through the coolant flow lines and coolant flow coil to cool the beverage in the chamber.

13. Apparatus as claimed in claim 12 wherein temperature sensing means are provided to monitor the temperature of the beverage stored in the chamber and control means are provided to adjust the flow rate of coolant through the coolant flow coil in response to the temperature sensor readings to achieve a required dispense temperature of beverage.

14. Apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes extending from a storage point to a dispensation point; cooling means located at or near the dispensation point; an expansion chamber at or

near the dispensation point through which the product flow tube(s) pass; and coolant flow lines connecting the cooling means to the expansion chamber; wherein volatile liquefied coolant is pumped from the cooling means to the expansion chamber where it boils to form a gas, thus cooling the beverage within the product flow tube(s) within the expansion chamber, and is then passed via the coolant flow lines to the cooling means where it is compressed and recirculated.

15. Apparatus as claimed in claim 14 wherein a temperature sensor is provided at or near the dispensation point to monitor the temperature of beverage dispensed, the cooling means being connected to the temperature sensor and automatically adjustable to change the flow rate of propellant through the expansion chamber to achieve the desired dispensation temperature.

16. Apparatus as claimed in either of claims 14 or 15 herein the propellant is 134a.

17. Apparatus for controlling the dispensation temperature of a beverage comprising one or more product flow tubes extending from a storage point to a dispensation point; a heater unit through which the product flow tube(s) pass to heat the beverage therein; temperature sensing means to monitor the dispensation temperature of the beverage, the output of the sensing means being connected to the heater unit; wherein the beverage is cooled remote from the dispensation point to a temperature below a required temperature and the heater unit raises the temperature of the beverage to the required temperature, the heater unit adjusting the rate of heating with regard

to feedback from the temperature sensing means such that the required dispensation temperature is maintained.

18. Apparatus as claimed in claim 17 wherein the heater unit is located at or near the dispensation point.

19. Apparatus as claimed in claim 17 wherein the heater unit is located remote from the dispensation point.

20. Apparatus as claimed in any of claims 17 to 19 wherein the temperature sensing means is located in the product flow tube(s) at or near the dispensation point.

21. Apparatus as claimed in any of claims 17 to 19 wherein the temperature sensing means is located in contact with a container containing the dispensed beverage.

22. Apparatus substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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Application No: GB 9715837.2
Claims searched: 12 & 13

Examiner: M C Monk
Date of search: 22 April 1998

Patents Act 1977
Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F4H (H2K)

Int Cl (Ed.6): B67D (1/08D)

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2131145 A	KANTO SEIKI KABUSHIKI KAISHA See eg Fig.3.	12,13
X	GB 1358415	TERUO KAWAI See eg Fig.2.	12
X	GB 1006989	CLEVELAND TECHNICAL CENTER Consider whole document.	12,13
X	GB 916924	DESSINDECOR LTD Consider whole document; thermostat phial (41).	12,13
X	GB 903955	DESSINDECOR LTD Consider whole document.	12.13
X	GB 693748	ICE WATER DISPENSERS LTD Consider whole document; thermostat (23).	12,13

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

The Patent Office

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Application No: GB 9715837.2 **Examiner:** M C Monk
Claims searched: 10 & 11 **Date of search:** 22 April 1998

Patents Act 1977
Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): F4H (H2K)

Int Cl (Ed.6): B67D (1/08)

Other:

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB 2204670 A	MK REFRIGERATION LTD See Fig.3; temperature sensor (19).	10,11
X	GB 1417406	MARSTON PAXMAN LTD Consider whole document; thermostat (16).	10,11
X	GB 1112664	MIECZYSLAW KOMEDERA See Fig.1.	10
X	GB 979035	BRITISH SYPHON CO Consider whole document; thermostats in tanks (8,9) control the operation of pumps (6,7).	10,11
X	GB 946602	BRITISH SYPHON CO Consider whole document; thermostat (19) in tank (9).	10,11
X	WO 86/00064 A1	UMMELS See eg the arrangement shown in Fig.1; pump (16), cooling water distributor box (15).	10

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Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

The Patent Office

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Application No: GB 9715837.2 **Examiner:** M C Monk
Claims searched: 1-2 **Date of search:** 29 September 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): F4H; F4S

Int Cl (Ed.6): B67D (1/08, 5/62); F25D (17/08)

Other: ONLINE DATABASE:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	WO 88/07162 A1	MARTIN Consider whole document; see especially Figs.1 & 2.	1,2
X	US 5456387	TREWHELLA See especially Fig.5 and the description at ll.21-41 column 4.	1 at least
X	US 4754609	THE CORNELIUS CO See especially the description at ll.34-62 column 4.	1,2
X	US 4730463	STANFILL See especially Fig.2 and the description at ll.40-54 column 2.	1,2
X	US 4676400	LAMONT & HANSEN Consider whole document; see especially the description relating to the manifold means (10)	1 at least
X	US 4094445	ELLIOT-LEWIS CORP Consider whole document; see especially the description relating to the supply line (14).	1,2

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

The Patent Office

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Application No: GB 9715837.2 **Examiner:** M C Monk
Claims searched: 1-2 **Date of search:** 29 September 1997

Category	Identity of document and relevant passage	Relevant to claims

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.